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ABSTRACT

The search for a work force preparation model that could serve as a guide for meeting present and emerging challenges has lead to a focus on the German dual system youth apprenticeship model. In this system, the practice-oriented part is taken over by commercial enterprises and theoretical knowledge is imparted by vocational schools. The trainee has a double role as an employee under contract to an enterprise and as a compulsory student at a vocational school. The federal government carries responsibility for framing skilled worker training in the enterprises. Current problems of apprenticeship programs are use and cost factors linked to the workplace and changes in the work process that have resulted in a different qualification structure. To improve vocational training against the background of changing job patterns, pilot projects have been introduced. All start from generally accepted key qualifications. Focus now is on the linkage of "learning and value adding" under real conditions. An exemplary project has implemented "decentralized learning" in "learning islands." The learning islands must be a reflection of the workplace structures. A proposed U.S. adaptation would be regional systems of apprenticeships across the nation that evolve out of a local school district, employer-union community, and labor market. Government's role should be to enact supportive legislation for local and regional apprenticeship initiatives as well as provide financial support. (Contains 15 references.) (YLB)

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Running head: GERMAN INDUSTRY EDUCATION PARTNERSHIPS

Lessons from German and American Industrial-Education Partnerships

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Abstract

In Germany it is claimed that the training of apprentices meets, in quality and quantity, the need for young skilled workers in industry and the trades and socializes youth for smooth school-to-work transition. One prerequisite for high quality and globally competitive production is, according to international opinion, an adequate number of well skilled workers. Because of the economic successes of the Federal Republic of Germany, other countries are seeking to emulate or adapt its training system. This system is changing, however, in Germany. The changes of the operational means (machinery and materials) and in the work organization of industry have also affected the training of apprentices. More specifically, the training of apprentices is now considered as a part of the process of value adding. The focus is now on the linkage of "learning and value adding" under real conditions. This paper documents an exemplar project which implemented "decentralized learning" in "learning islands." A proposed American adaptation of this innovative form of training will also be discussed.

Lessons from German and American Industry-Education Partnerships[1]

Introduction

The U.S. is in the process of rethinking workforce preparation. The impetus for this development is a growing awareness of the effects of recent economic and social change. The structural shifts in the economy over the past 25 years which include the decline in manufacturing, the rise in the service sector, the revolution in communications and the emergence of a global economy, have gradually increased the demands for better preparation of the labor force and more efficiency and effectiveness in our school-to-work programs. We have become increasingly aware that as a nation, our institutional arrangements to insure that future generations of workers acquire the skills necessary to keep the economy globally competitive and replete with sufficient employment opportunities appear inadequate.

Current workforce preparation programs in the U.S. fall general into one of four categories:

1. Registered apprenticeships, begun under the National Apprenticeship (Fitzgerald) Act of 1937, currently managed by the U.S. Department of Labor's Bureau of Apprenticeship and Training, and including over 300,000 apprentices.
2. On-the-job training (OJT) opportunities, i.e., in-firm training, for unemployed, low-income persons through the Job Training and Partnership Act of 1976.

3. Vocational education tracks in public high schools and Area Vocational Centers throughout the U.S., which are supported unevenly by local, state, and federal funds.
4. Public and private post-secondary schools, usually pay-as-you-go.

All of these programs have shown themselves inadequate in response to current needs. The registered apprenticeship programs are located only in certain industrial sectors and managed largely by unions who restrict access to union members. Outside of these industry sectors, employers have shown little interest in setting up apprenticeships. Also, registered apprenticeship programs are not designed for entry level young people with no significant work histories and the average age of apprenticeship applicants is 28 years.

The on-the-job training programs have had recurring difficulties regulating the quality of training rendered through the OJT arrangement and the target population is drawn largely from the lower end of the labor market. The common criticism is that employers tend to abuse the system by accepting program participants, but failing to teach new job skills or employ them past the paid training cycle.

Vocational education in the U.S. continues to be stigmatized as the track for less academically able students. It is a track often perceived as limiting employment futures rather than expanding them. Also, local employer evolvement has often been limited, and both secondary and post-secondary programs have relied upon a primarily classroom delivery system.

The search for a workforce preparation model which could serve as a guide for meeting present and emerging challenges has lead to a focus on the German "Dual

System" youth apprenticeship model, so called because it combines classroom instruction with practical learning in the workplace. Another advantage is that, in addition to skill training, it provide the socialization necessary for school-to-work transition. While the differing traditions between the two countries may impede the direct transferability of the model, there is much to be learned about how the German youth apprentice system operates and how similar positive outcomes might be institutionalized in a U.S. system (Frenzel-Berra, 1995).

Structure and Organization of the German "Dual System" of Vocational Training

The educational system of the Federal Republic of Germany differs widely in its structure from those in other European and non-European countries. To gain an understanding of the problems to be dealt with in the described project, it is first necessary to have a brief view of the "dual system", which precedes the detailed elaboration of the presentation's themes.

The educational system of the Federal Republic of Germany is divided into general education and vocational training. The vocational training system is based on the system of general educational schools. This means achieving the secondary school qualifications is the precondition for the start of appropriate vocational training. General education is derived from a humanistic education definition. Its purpose consists in imparting cultural techniques and the preparation of learners for their present and future world of living. Its score and main goal is the development of a broadly educated individual. General education can also be considered as a preparation for subsequent vocational training.

On the one hand, vocational training qualifies a skilled worker for a profession, which could be technical/industrial, commercial or social/nursing in nature. On the other hand, vocational training qualifies persons for the technical college. The curricular link to the system of general education is realized through the preparatory functions of the secondary school level "I" qualifications are usually the precondition[2] for a skilled worker's training; the secondary school level "II" qualifications (Abitur) are the entry conditions for a study at a university.

Fig. I: **Educational System of the Federal Republic of Germany (FRG)**

In the FRG, vocational education, i.e., skilled worker training, is experienced by approximate 60-70% of the youth and it is realized through a cooperative "dual system" consisting of training at commercial enterprises or similar institutions and vocational schools. In this system of "dual vocational training", the practice-oriented part is taken over by the commercial enterprises in the economy, and theoretical knowledge is imparted by the vocational schools. The trainee has to fulfill a double role, firstly, he/she is an "employee" under contract in an enterprise (company) and secondly, a "compulsory" student at a vocational school.

The responsibility for framing skilled worker training in the enterprises is carried by the Federal Government. This training framework was established by the Federal law for vocational training in 1969. The law's regulations include, among other things:

1. vocational training relations (reasoning, content, beginning and termination)
2. regulations for vocational training (authorization for employment and training, recognition of qualified jobs, alteration of training duration, examination procedures,

control and monitoring of vocational training, etc.)

3. committees for vocational training (Federal Committee, Federal State [Land] Committees, etc.)

The given framework, as specified by law, applies to all qualified jobs and is differentiated, in respect to single occupations, by the decrees for training. This differentiation for the professions in industry, trade and craft is enacted by the Federal Ministry of Economy in agreement with the Minister for Research and Technology, which is also responsible for the relatively few educational responsibilities held at the federal level.

In the Federal Republic of Germany (FRG), framework is given to the enterprises involved in occupational training in industry, trade and craft, by means of these legal regulations. It guarantees the trainees an appropriate standard during the time of training, which has to be proven by succeeding in a substantial examination.

The vocational school, as a partner of the vocational training, belongs to the school system and therefore is a part of the responsibility of the Lands (states) of the FRG, which are in a cultural sphere of their own. The guidelines embracing the laid down contents of occupations in the form of curriculum framework are released by the Lands through their Ministries of Culture, developed with the participation of the Industry and Trade Chambers and also the trade unions. The curricula frameworks must have a direct correlation to the decrees of training, to ensure the coordination or in other words the "inter-locking" of the two learning locations, enterprise (company) and school. This

linkage is critical, especially when the educational system has to answer to the demands of efficiency.

If the example of training in metal industrial occupations is scrutinized, one will find six occupations encompassing 16 specialties in this industry field; the training duration being uniformly decreed at 3.5 years. The sequence of training can be described as follows:

1. in the first year of education broad vocational basic training is provided, addressing the same content of the occupational field taught at the enterprises and the vocational schools.
2. during the first half of the second year the specialized training of several occupations is combined (industrial mechanic/toolmaker) and the second half of the year provides specialized training in a single field.
3. the third year provides a deepened training corresponding to the various specializations of the occupation.

Company training in industry and craft occupations differ from each other. The industrial sector training is given in central training centers, but the training in a craft and trade is exercised as "side training" (Beistellehre)[3]. During the training period, workplace orientation is secured through periods of practice at the companies.

The dual vocational training system is a model, based on broad consensus and agreement, that defines the frame for all participants. However, because the agreement process takes several years, occasionally difficulties arise in reacting promptly when alterations are necessary due to technical innovation.

Current Problems of Apprenticeship Programs

Over several decades the dual system of vocational training has proven its validity. More recently, however, various aspects have been called into question as described in more detail in the following.

The training for an occupation is not an independent activity, rather it involves utilization and cost factors always linked to the appropriate workplace. From the company's point of view, as it bears the costs of training, a skilled worker's qualification must correspond with the company-oriented work process. Besides the demands in the curricula framework, the specialized training has also to provide company-oriented capabilities and fixed knowledge.

Within the past few years the work process was subject to constant changes in all industrial sectors, due to automation and rationalization of the production process, having led to a different qualification structure of the employees. Nowadays, a metal cutting mechanic produces his products not just by using a CNC machine, rather he is acting as a system user of a machine complex, and he solves technical as well as organizational tasks and uses production processes, which are the responsibility of the whole process.

From the company's view, a further aspect is to be seen in the need for future young talent. Increasingly, changes in the enterprises have led to redundancies among employees including skilled workers. Figures reflecting the need of skilled workers in the automotive and the electrical industry indicate a reduction of approximately 40% when related to the available places of training in 1996. Until now, nearly 100% of the

trainees have been taken on by the companies, but this is secured only for a limited time to come. The qualifications of the skilled workers have more than ever to conform with the company's profiles and only in the second instance with the objectives of the curricula framework. Training must be considered as preparing human capital for running and optimizing the production process, and for its development the company must provide the means of cost centers. This changed point of view of employees must be seen in connection with the international comparison of the cost factor "human capital development." How, within the dual training system, the requirements of enterprises can be met, will be shown on the one hand by an example using key qualifications, and on the other hand describing "learning islands."

Flexibility of Training Through Key Qualifications

With the aim of improving vocational training against the background of changing job patterns, a number of pilot projects have, in association with Bundesinstitut fur Berufsbildung BIBB (Federal Institute for Vocational Training) , been introduced in different industrial firms in the Federal German Republic. Issues under review were those of enhanced mobility, social competence and self-instruction, to mention but a few. Although the experiential phase has produced company-specific training schemes, they all start from generally accepted key qualifications.

Within the industrial context it is logical to consider key qualifications as an essential principle in developing concepts of human resources management and of training strategies (Klein, et. al. 90). They gain significance since the flexibility of the workforce is regarded as an effective means of reducing the qualification pressure,

which acts both on the company and on its staff, and which is dictated by the constantly reduced innovation inherent in technical systems. These considerations apply to all the levels at which knowledge is imparted.

Fig xx: **Overview of Key Qualifications**

The project and transfer-oriented training scheme PETRA (Projekt-und Tranferorientierte Ausbildung PETRA) adapted by Siemens, Germany, is to serve as an example in this connection. Here, the new approach in vocational training consists in a methodological accent on shop projects supported by the "Leittext" method (or key material method), which supersedes the four-stage method[4]

The PETRA model concentrates on five dimensions: task organization, communication and operation, application of learning, strategies and mental work, self-reliance and responsibility, and endurance. The main areas of the PETRA key qualifications consider future requirements in industrial enterprises. According to PETRA, the development of individual and group-based "job organization, job-execution, and perpetuation of results" evidently are a major concern of an industrial enterprise as this enables its staff to respond without delay to new work situations. As part of the educational objective "learning behavior, evaluation and passing on of information."

The concept of key qualifications is based on the imparting of performance and behavior dimensions, whereas the flexibility, necessitated by changing workplace demands, is given through the transfer of problem-solving strategies. Therefore, the

imparting of key qualifications is also bound to specific learning situations.

Company Orientation Through Workplace-Based Learning Locations

To fulfil the demand for company-oriented training, workplace-based learning locations must be developed. In today's real working world, it is no longer practical to provide extra training places, especially if one wishes to overcome the division of theory and practice. The demand for a new learning approach, taking into account the development of key qualifications, requires forms of production-based learning. They are the preconditions, if performance competencies are to be enhanced when viewed under specialized and social aspects and practiced by groups of various ages and different professional backgrounds.

In the past few years, "work and product-oriented learning," "learning islands," have been implemented. The intended aims can be described as follows.

They should:

1. erase the difference of preconceptions in regard to the required qualification between the training and the process level.
2. lead to shortening of the settling-in period of the skilled worker at the future workplace in the enterprise.
3. through value adding, in the period of vocational training, give the trainee freedom for entrepreneurial, comprehensive and thus responsible acting.
4. lead to a reduction in training costs through a stronger involvement of the trainee in project/assignment work, after the first year of training (basic training).

At the learning islands, company-oriented and external assignments (orders) are realized, to align with the comprehensive approach being linked to these objectives. This concept emphasizes that there can be "company-oriented learning islands" only. They must be the reflection of the company, insuring that the learning islands only be defined by the company itself, accounting for pedagogical personnel development-oriented guidelines.

The work and learning within these learning islands should be bound to assignments, which reflect the spectrum of company production. In that sense the learning islands have to be a reflection of the workplace structures. To correspond to the pedagogical objectives like comprehensiveness, teamwork ability, etc., the orders should contain only a certain degree of complexity, but also a sensible work content and extent to practice cooperative handling and action competence[5]

The action of the team, which consists of trainees and trainers, is identified as follows:

1. practiced, entrepreneurial thinking and economical acting by taking on the responsibility for the result (quality) accountable to the customer.
2. mutually developed working plans, considering costs factors - when acquiring operative action competence in larger information nets, aiming at the recognition of the information flow, selection and evaluation of relevant information.
3. mutually found and accepted, specific decisions for processing the assignment (order).
4. mutual assessment of the activities, eventual corrections and accountability.

5. search for interface, competence and coordination in problems of logistic systems and involvement through creative proposals for their solution.

6. exercises for overcoming situations of disturbance through problem recognition and solution by selecting and evaluating alternatives - recognition of the comprehensive character of system-linked production processes.

In the FRG, in a number of enterprises, learning islands have been created with different emphasis[6]. The following description is based on product-oriented views of industrial technical training.

Steel industry:

The Hoesch-Stahl AG initiated the pilot project "Cooperative Vocational Training in modern Process Production", focusing especially on professions in service and maintenance. Therefore, learning islands for "Repair, Service and Maintenance" were created.

Automobile industry:

Volkswagen AG established the learning island concept in various of their plants. The first phase produces and distributes components for vehicles being manufactured in company-internally and internationally located production places within or parallel to the manufacturing line, training is imparted, and the learning locations are selected future workplaces.

At Mercedes - Gaggenau - learning islands consist of assembly platforms producing special parts as such for the Unimog gear box. Learning islands for "Service and Maintenance" were also introduced.

Construction engineering in machine engineering:

By creating learning islands of group works, the Schenk AG focuses especially on the aspect of quality assurance. The orders are processed and costs calculated starting from work preparation in agreement with the training section. The time frame is given for processing the orders, and the results including quality, are shown in the production statistics. To embed the learning island concept in the training program, the first year of training prepares the trainees, at the training centers and within the frame of basic training through seminars, for the demands of working in teams.

Essential features will be explained by taking the learning island "Repair shop" of an enterprise in the steel industry for an example. It operates as a self-sufficient workshop and takes the function as "Cost Center" in the training center. Consequently, it is profit-oriented. Coordination between the Cost-Center Management of the learning island (Trainer Team) and the other Cost Centers of the enterprise will become necessary to reach full utilization of the capacity of the learning island "Repair shop". In some cases external orders will have to be acquired.

As a pilot project, the repair of a pump was undertaken, an assignment typical in the spectrum of the companies operations. The job was an order-oriented and structured project as it is defined for the training sector. The structured principles implied the use of the "Leittext" method, this teaching learning system assuming a major role in the organization of the entire learning process. The advantage of this method was that individual educational actions were promoted.

The example of the repair order was accomplished with order-oriented key materials. They insured that the requirements of "Total Quality" were maintained. What should be underlined is that this also goes along with a new understanding of assessment, considering not only cognitive abilities, but also handicraft skills and affective attitudes.

Fig x: **Learning Potential and Participation in Customers Orders (Hahne, Selka 1993)**

This structure related to the key qualifications can be transferred to a lot of other jobs, as they appear in industry and trade. The structure, which is therefore introduced by successful completion of jobs on the shop floor, is fundamental for learning islands.

The concept of the workshop section is structured to undertake metal and electrical work as well as the commercial functions for handling the orders. The equipment compares to a small enterprise/department section, and acts entreprenurially. To keep the costs for the equipment within limits, the machines, devices and computers (necessary for communications with other learning islands and access to company-internal information) were taken from workshops and training sections. The structuring had to be especially conformed to the work organization of the company.

The equipment of learning islands and their inclusion in the training concept by trainers must be considered as "prototyping" and accomplished mutually with the responsible persons at the process level. The trainer team must consider it as preparation for the future management of the learning islands. In that way, the trainer team is provided with an innovational field, having the possibility to include trainees in

this process. The planning operation has to be seen as a self-learning and experiential process using review and integration of production processes. Simultaneously, existing structures in the training centers of enterprises are broken open by integrating the production/manufacture-oriented value adding learning islands into the company training. Consequently, a new definition of the tasks of the training management and training personnel in relation to the production processes of the company must follow.

By introducing learning islands the economic dimensions and the consequences for vocational schools must also be considered. Creating learning islands means the creation of learning places similar to workplaces existing in the enterprise. Investment costs can roughly be calculated by considering the number of trainees, usually 6 trainees, and the trainer. Exact figures pertaining to the value adding of the learning islands cannot be given. An estimate could be made from figures taken from the craft area. Even as the situations in various professional fields are different, one can estimate a value adding of 50% per trainee (third year), reduced by 10-20% through participation of the trainers/masters fully integration in the work process. The cost for trainees can be remarkably reduced if one considers in this calculation the lack of a settling-in period. The dual system of skilled worker training is based on both of the learning locations - company and vocational school. Constraints exist through the administration of contents of the overall training plans by having common requirements. However, the orientation of learning islands focuses on company-specific contents, opening the question of the integration of the necessary theory by continuously changing order-oriented problems. By enhancing self-controlled learning during the

training period, the answer could be, that the vocational school must deliver the professional basics at the beginning of the training period with the emphasis on transversality of the theory. This opens up questions of an appropriate inter-locking between vocational schools and companies and the acceptability of value adding training design options. It also opens up questions of practice and theory implementation and consequently how efficient and sustainable the "dual system" is in its current form.

Summary

By combining "learning and producing" in the learning islands, a new way for the comprehensive personal development of the trainees and new self-understanding of the trainers is created. It has become a necessity that, on the one hand the trainees, as future employees must work side-by-side in problem solving and communicate inter-departmentally, and on the other hand that the trainers be again integrated into the process level. The learning island concept will take a central function in the implementation of this objective, to combine the nationally defined standards of skilled worker training and the qualification requirements of the enterprise. Also, the creation of learning islands will have a trend-setting importance in regard to extended vocational and continuing further training, which will become more and more workplace-oriented. The learning island concept will not only promote the high standard of quality of the young skilled workers in the concerned enterprises, but also it will influence the supplying firms.

A Proposed American Adaptation

At the most general level, the U.S. has a wide variety of training programs. At the same time it lacks a transparent (the extent to which the student can see the future possibilities implied by his or her current education; Hamilton and Hurrelmann, 1993) coherent, integrated system of initial training which, like the dual system of apprenticeship in Germany, bridges the transition from school to work. Features which make the "Dual System" particularly attractive include:

1. well-defined, nationally recognized skill standards for the apprenticed occupations.
2. a comprehensive system which includes all major industries;
3. a system jointly supported and steered by business, unions, and schools;
4. an inclusive system which serves over 60 percent of the nation's youth;
5. a system which provides an effective transition and socialization from school to work;
6. a system which combines classroom instruction with practical workplace learning.

Issues raised by authors who have argued persuasively in favor of a U.S. youth apprenticeship system (Hamilton, 1990 and 1993, Glover, 1990, Glover and Marshall, 1993; Franzel-Berra, 1995) and against one (Crouch, 1993, Kantor, 1994) have defined several cultural, institutional and economic factors which should be considered parameters within which an American youth apprenticeship model can evolve:

1. the autonomy of over 16,000 local school districts;
2. the autonomy of individual firms and their aversion to external regulation of internal training and hiring practices;

3. the sacredness of the college option and individual choice in selecting vocational training providers;

4. the cultural acceptability of an 'experimental period' in occupational selection for young people;

5. social class competition for jobs, training opportunities, and public funds.

Recent developments in public policy in this country, have begun to create opportunities for the evolvement of youth apprenticeships. Development of multi-campus community based and relatively low cost vocational technical college systems in most states, and, in many places, serious attempts to articulate the various levels of secondary and post-secondary schools, particularly in occupationally oriented areas, have created climates where youth apprenticeships could flourish. The 'applied academics' movement, Tech Prep and efforts to develop skill standards are other very promising developments. Indeed, the evolution of the German "Dual System" of vocational education to better meet individual companies needs as outlined earlier in this paper, better fits the parameters within which a U.S. model is likely to evolve. Serious proponents of youth apprenticeship in this country should widely publicize the dynamic aspects of the German model and its ability to meet the needs of the local industries and minimize costs.

These parameters do not point to an encompassing, national system of apprenticeship as in the German model, or even a state wide system and certainly not government regulated. Rather, they point to the possibility of regional systems of apprenticeships taking hold across the nation. They must evolve out of a local school

district, employer-union community, and labor market. The role of government should be to enact supportive legislation for local and regional apprenticeship initiatives as well as provide financial support.

Future receptivity will depend upon the extent to which businesses work out new ways to work closely with local schools, both secondary and post-secondary. Youth apprenticeships must succeed as a way for local business and industry, particularly small and medium-sized enterprises, to recruit local youth from the middle of the employment spectrum, or they will not take hold. If the businesses involved begin to rely upon apprenticeship graduates to fill their job openings, local youth begin to complete for apprenticeship openings, and local schools form a new commitment to learning among the apprentices, an American style youth apprenticeship will emerge.

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Footnotes

[1]This paper is the result of collaborative research by the authors at the Institut fur Angewandte Elektrotechnik und Technikpadagogik der Universitat Hildehseim (Institute for Applied Electrical Engineering and Technology Education at the University of Hildesheim/-Germany). The research assignment of Prof. Dr. A.R. Putnam, Indiana State University, was sponsored by the Fulbright Commission.

[2]In the FRG, large enterprises demand an entry test and interviews.

[3]Side training means, trainee and trainer are collaboratively engaged in the working process. High-Tech demands are provided in special occupational training centers for craft.

[4]The shop project method is seen as the key for imparting key qualifications that enable the apprentice to acquire specific knowledge and abilities. By stressing the taxonomic steps "reorganization", "transfer" and "problem-solving" as recommended by the Council for Education in 1970 to distinguish between individual stages of learning.

[5]The work tasks have to demand full action of the trainee. "Full action" means follow-up the aim, subject to cognitive preparation of the action plan. Full action includes controls and evaluation of the action results. Motivation factor is the resultant aim. Each trainee should have a vision of his aim to stand for it. This entails various approaches by the trainees offering multiple but equally valid solutions to the task.

[6]Presently, there are no experiential results of Pilot Projects available, but a broad offer of experience reports. After a difficult phase of introduction at the enterprises, the projects are positively evaluated (Hauni 1996); a positive trend for having more learning islands in enterprises is distinguishable.

Education in Germany

The basic structure of the German education system

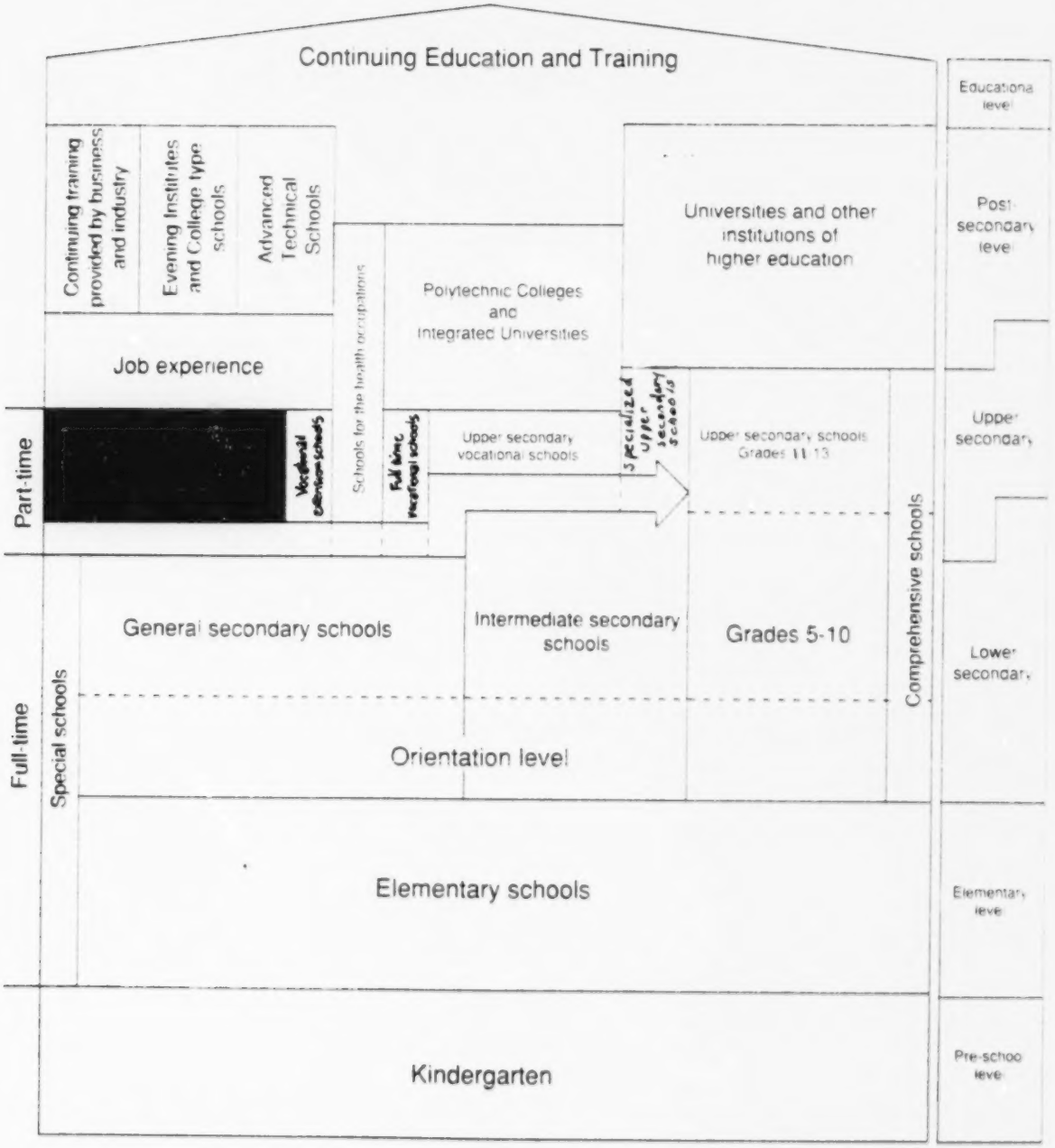

FIG. 1

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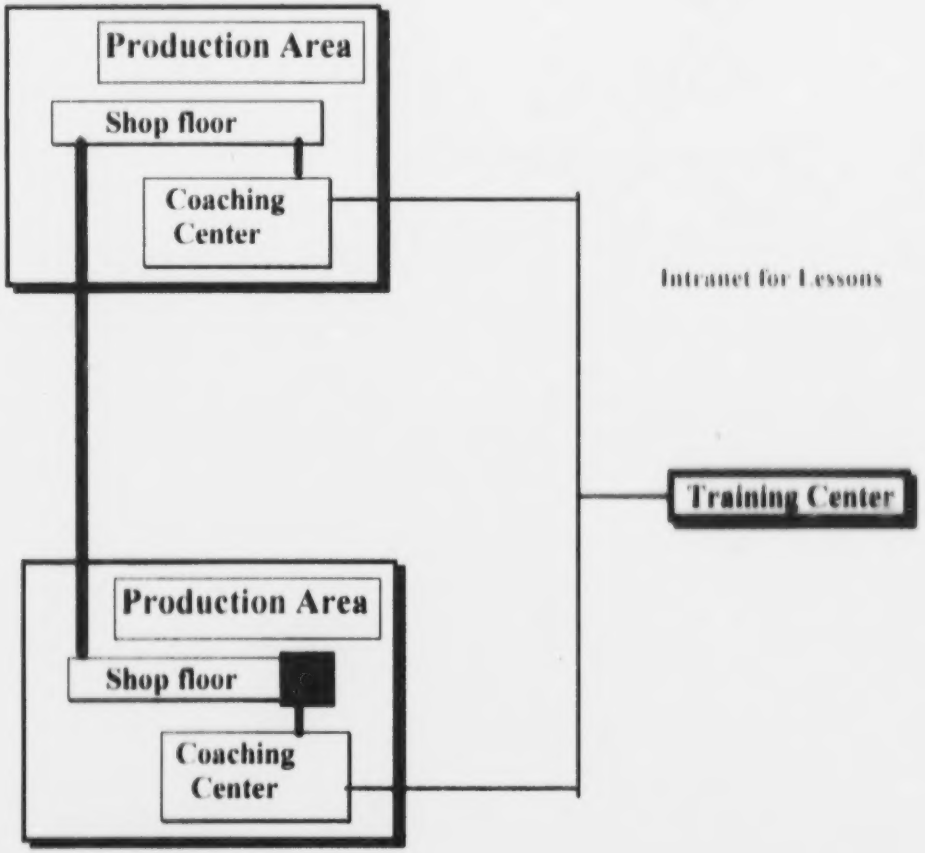
New Learning Demands

The world of work can no longer be duplicated in training schools

New requirements can no longer satisfied by using classroom education

Overcome that the separation of theory and practice is necessary

Learning within production area can advance occupational and social capability and further profession and generational group dynamics



Key Qualifications

Dimensions:	Organisation and execution of exercises	Communication and cooperation techniques	Application of learning and mental working	Indepence and responsibility	Maximun capacity
Target:	Work planing Work process results teamwork	Social behavior within the group and toward others,	Learning behavior, evaluation and communication	Self- and responsibility in the work process social	Psychological and stress
Qualific..					

Quality-conscious

Thinking in systems
Thinking in algorithm

Convert theorie in practice
Capability to decide

Self-assessment
Self-discipline

FIG. XX:

Source: Borretty, R.; u.a. : Petra. Projekt- und transferorientierte Ausbildung München 1988 S. 20

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